REMARKS

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended claim 1 to recite that the relative viscosity of the polyamide A1 is less than the relative viscosity of the polyamide A2. Note, for example, Examples 1 and 2 on pages 22-24 of Applicants' specification; and, in particular, page 22, lines 18 and 19, as well as page 23, lines 11 and 12, of Applicants' specification. Applicants have amended claims 5 and 6 to correct grammatical errors.

Comments by the Examiner in connection with the election set forth in the Response filed April 24, 2006, on page 2 of the Office Action mailed July 13, 2006, are noted. For clarification, and noting the second full paragraph on page 3 of the Response filed April 24, 2006, the election of the Group I claims is an election of claims 1-13.

Noting that the Examiner has made the restriction requirement Final, in the Office Action mailed July 13, 2006, Applicants respectfully maintain non-elected claims 14-16 in the above-identified application, subject to the taking of further action in connection therewith; e.g., filing of a Divisional application or applications, or action under 37 C.F.R. §1.144.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the references applied by the Examiner in rejecting claims in the Office Action mailed July 13, 2006, that is, the teachings of the U.S. Patent documents to Sato, et al, Patent Application Publication No. 2001/0056148 A1, and to Gross, et al, Patent No. 4,857,600, under the provisions of 35 U.S.C. §103.

Initially, and for purposes of completing the record, it is to be noted that the application published as No. US 2001/0056148 A1 has now issued as US Patent No. 6,515,099, issuing February 4, 2003.

It is respectfully submitted that these references as applied by the Examiner would have neither taught nor would have suggested such a process for producing a polyamide composite material including, inter alia, polyamide A1 and polyamide A2, as in the present claims, including, inter alia, a step of melt-kneading the polyamide A1 and organized clay B substantially by dispersive mixing in a kneading section (a) of a corotating intermeshing twin-screw extruder, to obtain a melt-knead product; transferring the melt-knead product from the kneading section (a) to a feed section (b) of the aforementioned twin-screw extruder, and simultaneously feeding a polyamide A2 into the feed section (b) through a feed port (b), the polyamides A1 and A2 having specified relative viscosities, and wherein the relative viscosity of the polyamide A1 is less than the relative viscosity of the polyamide A2; and melt-kneading the melt-knead product and the polyamide A2 substantially by distributive mixing in the kneading section (b) to prepare the polyamide composite material. See claim 1.

As will be discussed further infra, by utilizing polyamides A1 and A2 as in the present claims, having the recited relative viscosities with respect to each other, advantages are achieved by the present invention, including better dispersal of the organized clay B in the polyamide composite material without degeneration of the polyamide materials, providing a composite not only excellent in gas barrier properties and transparency, but also free from malodor. Such advantages achieved according to the present invention are

enhanced in view of the melt-kneading of the polyamide A1 and the organized clay B <u>substantially by dispersive mixing</u> in the kneading section (a) to obtain a melt-knead product, with subsequent melt-kneading of the melt-knead product and the polyamide A2 <u>substantially by distributive mixing</u> in the kneading section (b).

Moreover, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such a process for producing a polyamide composite material as in the present claims, having features as discussed previously in connection with claim 1, and, moreover, the additional features set forth in the dependent claims, including wherein melt-kneading the polyamide A1 and the clay B is performed by a portion of a screw comprising a group of elements having a high dispersive mixing capability, and wherein melt-kneading the melt-knead product and the polyamide A2 is performed by a portion of this screw including a group of elements having a high distributive mixing capability (see claim 2; note also claims 3 and 4, as well as claims dependent therein); and/or length of the screw in each of the kneading sections (a) and (b), as in claim 9; and/or melt-kneading temperature in the kneading sections (a) and (b), as in claim 10; and/or specific energy provided by the corotating intermeshing twin-screw extruder as set forth in claim 11; and/or overall residence time of the kneading, as in claim 12; and/or wherein the process satisfies the requirements as in claim 13.

The invention as claimed in the above-identified application is directed to a method of forming a polyamide composite material excellent in gas barrier properties and transparency.

In recent years, there is a strong demand for packaging materials capable of keeping freshness of foodstuffs, beverages, etc., for a prolonged period of time, and nylon MXD6 (produced by the polycondensation of a diamine component mainly composed of m-xylylenedaimine and a dicarboxylic acid component mainly composed of adipic acid) has been used for this purpose; and there has been a requirement that the nylon MXD6 has enhanced gas barrier properties. A method for enhancing gas barrier properties of polyamide is to uniformly disperse phyllosilicate in a polyamide thereby to prepare a polyamide composite material. However, proposed techniques for forming a polyamide (e.g., nylon MXD6) having phyllosilicate uniformly dispersed therein has various problems. For example, heat generated by shearing decomposes the organizing agent in the organized clay,, to allow agglomeration of the clay, and therefore the clay fails to be completely and finely dispersed and/or distributed in the polyamide. Also, there occur problems such as deterioration in transparency, increase in YI and malodor development due to decomposition of the organizing agent of the organized clay.

Against this background, and as a result of extensive studies, the present inventors have found a polyamide composite material, produced by melt-kneading specified polyamide components with an organized clay under specific conditions, which composite material is not only excellent in gas barrier properties and transparency, but also free from malodor. Applicants have found that by melt-kneading a polyamide A1 and the organized clay B substantially by dispersive mixing to obtain a melt-knead product; and, subsequent thereto, melt-kneading the melt-knead product and a polyamide

A2 substantially by distributive mixing to prepare the polyamide composite material, with the relative viscosity of the polyamide A1 being less than the relative viscosity of the polyamide A2, objectives of the present invention are achieved, and a composite material having enhanced gas barrier properties without deterioration of other properties, as discussed in the foregoing, is achieved. Specifically, through melt-kneading the polyamide A1 and organized clay B by <u>dispersive</u> mixing, the clay B can be finely dispersed or distributed in the polyamide. Moreover, the composite can be effectively completed through use of the kneading of the melt-knead product and polyamide A2, by <u>distributive</u> mixing.

In connection with the distributive and dispersive mixing, attention is respectfully directed to the discussion of these mixing actions in the paragraph bridging pages 13 and 14 of Applicants' specification. Thus, the dispersive mixing is a mixing action accompanied by reduction in particle size, mainly, crush of particles, while the distributive mixing is a mixing action by the positive exchange of a particle with another. The mixing with high dispersive mixing capability means a mixing substantially governed by the crush of the polyamide A1 and the particles of the organized clay B, while the mixing with high distributive mixing capability means a mixing substantially governed by the position exchange of the polyamides A1 and A2 with particles of the organized clay B.

Attention is also directed to the sole full paragraph on page 11 of Applicants' specification. As can be seen therein, use of both the <u>dispersive</u> and <u>distributive</u> mixing of materials recited as in the present claims, provides various advantages. For example, where dispersive mixing capability is low

(not high as in the present claims), the organized clay is not sufficiently crushed nor finely dispersed owing to an insufficient shear stress applied thereto; and where the distributive mixing capability is low (not high as in the present claims), the melt-knead product of the polyamide A1 and the organized clay B tends to be insufficiently mixed with the polyamide A2. As to a further discussion of advantages achieved according to the present invention, note, for example, the paragraph bridging pages 14 and 15 of Applicants' specification.

Sato, et al, discloses a method for producing a polyamide resin shaped article, comprising preliminarily melt-kneading 70-95 mass % of a polyamide resin A and 30-5 mass % of a silicate B under specified conditions, thereby preparing a resin composition C ; melt-kneading 3-40 mass % of the resin composition C and 97-60 mass % of the polyamide resin A, under specified conditions ; and then shaping or molding the melt-kneaded product into the polyamide resin shaped article in which the silicate B is uniformly and finely dispersed throughout the polyamide A. Note paragraph [0013] on page 2 of Sato, et al. Note also paragraphs [0020] and [0021] on page 2. As to the production method, note paragraphs [0027], [0028] and [0030] on page 3 of Sato, et al.

Paragraph [0030] discloses that the incorporation of the silicate B to the polyamide resin A is generally performed by conducting the melt polymerization for producing the polyamide resin in the presence of the silicate B under stirring, or by melt-kneading the polyamide resin A and the silicate B in various usual extruders such as a single or twin screw extruder.

See also paragraphs [0034] and [0035] on page 4 of the Sato, et al, disclosing melt kneading of the resin composition C and the polyamide resin A.

As seen in the foregoing, as well as from a full review of Sato, et al, it is emphasized that Sato, et al, takes a part of the polyamide resin A, and subsequently uses another part of the polyamide A. It is respectfully submitted that this references does not disclose, nor would have suggested, and in fact would have taught away from, such method as in the present claims, including, inter alia, wherein the relative viscosity of the polyamide A1 is less than the relative viscosity of the polyamide A2.

Furthermore, it is respectfully submitted that Sato, et al, would have neither taught nor would have suggested the respective dispersive mixing and distributive mixing as in the present claims. Moreover, it is respectfully submitted that Sato, et al, would have neither taught nor would have suggested advantages achieved in light of the various features of the present invention.

It is respectfully submitted that Gross, et al, would not have rectified the deficiencies of Sato, et al, such that the presently claimed invention as a whole would have been obvious to one of ordinary skill in the art.

Gross, et al, discloses a process for grafting unsaturated aliphatic diacid anhydrides onto a polyolefin, the process including passing molten polyolefin through at least two injection zones connected in series; and injecting, under grafting conditions, a portion of a solution comprising the anhydride, an organic peroxide catalyst, and an inert organic solvent into the molten polyolefin as it passes through each injection zone, and mixing the same in each injection zone until the portion is at least partially grafted onto

the polyolefin. See column 1, lines 45-56. Note also the paragraph bridging columns 2 and 3 of the this patents, disclosing various types of mixers and extruders which can be used to carry out the process.

Initially, it is respectfully submitted that the teachings of Gross, et al, are not properly combinable with the teachings of Sato, et al, as applied by the Examiner. In this regard, it is emphasized that Sato, et al, is concerned with providing a polyamide resin having incorporated therein, e.g., a layered silicate; while Gross, et al, is concerned with a process or grafting an anhydride of an unsaturated aliphatic diacid onto a polyolefin. As can be appreciated, in Sato, et al, clay is fed in a solid condition to mix with a resin. In contrast, according to Gross, et al, a solid is mixed for allowing to react with a solution. In view of the different technologies involved in connection with Sato, et al, on the one hand, and Gross, et al, on the other, it is respectfully submitted that one of ordinary skill in the art concerned with in Sato would not have looked to the teachings of Gross, et al. In other words, it is respectfully submitted that these two patent documents are directed to non-analogous arts.

In any event, noting differences in the procedures in Sato, et al, on the one hand, and in Gross, et al, on the other, it is respectfully submitted that the Examiner has pointed to no proper motivation for combining the teachings of Sato, et al, and Gross, et al, as applied by the Examiner. Of course, without motivation for combining teachings of the references, such combination of teachings is improper.

In any event, even assuming, arguendo, that the teachings of Sato, et al, and of Gross, et al, were properly combinable, such combined teachings

would have neither disclosed nor would have suggested the presently claimed invention, including features thereof as discussed in the foregoing, such as (but not limited to) relative viscosity of polyamide A1 relative to that of polyamide A2; and/or melt-kneading the polyamide A1 and the organized clay B substantially by dispersive mixing to obtain a melt-knead product, with the melt-knead product and the polyamide A2 being melt-knead substantially by distributive mixing to prepare the polyamide composite material; and/or other features of the present invention as discussed previously, and advantages thereof.

On page 3 of the Office Action mailed July 13, 2006, the Examiner contends that Sato, et al, discloses a process of making composite polyamide compositions, including, inter alia, mixing under conditions corresponding to the conditions of the first section of the presently claimed extruder, and a second step of mixing in a second extruder operating at conditions similar to the conditions/configuration of the second part of the claimed extruder. It is noted, however, that the present claims recite respective melt-kneading steps substantially by dispersive mixing and substantially by distributive mixing. It is respectfully submitted that the Examiner errs in contending that Sato, et al, operates at conditions similar to those of the presently claimed extruder.

The contention by the Examiner on page 3 of the Office Action mailed July 13, 2006, that the components A1 and A2 "as claimed are indistinguishable from each other as having the same compositions and overlapping viscosities", is noted. Such contention by the Examiner is incorrect, in connection with the present claims reciting that the relative viscosity of the polyamide A1 is less than the relative viscosity of the

polyamide A2, and especially in view of advantages achieved thereby as discussed in the foregoing.

The contention by the Examiner on page 4 of the Office Action mailed July 13, 2006, that Gross, et al, discloses that single extruders with multiple feeding ports and mixing sections are known, is noted. It is respectfully submitted that Gross, et al, shows that such extruder is known in processes for grafting diacid anhydrides. In view of the entirety different technology involved therein, it is respectfully submitted that the Examiner has not established obviousness of using an extruder as recited in the present claims, much less the processing recited in the present claims, utilizing the extruder as recited herein.

Clearly, even combining the teachings of Sato, et al, and of Gross, et al, as applied by the Examiner, such combined disclosures would not have taught, nor would have suggested, the melt-kneading substantially by dispersive mixing in the kneading section (a) to obtain a melt-knead product, and the melt-kneading substantially by distributive mixing in the kneading section (b) to prepare the polyamide composite material, and advantages achieved thereby.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently in the application are respectfully requested.

To the extent necessary, Applicants petition for an extension of time under 37 CFR §1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to

Deposit Account No. 01-2135 (Case No. 396.43162X00) and please credit any excess fees to such deposit account.

Respectfully submitted,

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